

CLAIMS

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Sub A1
1/ A composition containing an active agent encapsulated within multilamellar vesicles presenting an onion-structure and constituted, from their peripheries to their centers, by concentric membranes in the form of bi-layers comprising at least one surfactant, said membranes being separated by an interstitial liquid, the composition being characterized in that said vesicles contain at least one agent intended to avoid the
10 degradation of said active agent.

15 2/ A composition according to claim 1, characterized in that the interstitial liquid is water and in that the active agent is included in the membranes of said vesicles when it is hydrophobic or in the interstitial liquid when it is hydrophilic.

20 3/ A composition according to claim 1 or 2, characterized in that said vesicles are of dimensions lying in the range 0.1 μm to 50 μm , and preferably in the range 0.2 μm to 10 μm .

25 4/ A composition according to any one of claims 1 to 3, characterized in that the membranes of said vesicles comprise a mixture of two surfactants respectively referred to as a lipophilic surfactant, having a hydrophilic-lipophilic balance (HLB) in the range 3 to 7, and a hydrophilic surfactant, having an HLB in the range
30 8 to 15.

35 5/ A composition according to any one of claims 1 to 4, characterized in that the membranes of the vesicles contain at least one polymer surfactant or a polymer having amphiphilic properties.

6/ A composition according to any one of claims 1 to 5, characterized in that said active agent is selected from

the group constituted by reducing molecules, oxidizing molecules, molecules sensitive to hydrolysis, in particular vitamins, enzymes, and proteins.

5 7/ A composition according to any one of claims 1 to 6, characterized in that said active agent is a substance sensitive to oxidation and said agent whose degradation is to be avoided is a substance known for its anti-oxidizing properties because of its reducing properties
10 or because of its action for reducing the risk of oxidation by a trapping effect, e.g. by an effect of trapping traces of oxidation-catalyzing metal ions contained in the medium, or by acting on the pH of the medium when the redox potential depends on pH.

15 8/ A composition according to claim 7, characterized in that said vesicles contain, as the active agent, vitamin C or a derivative thereof, together with at least one agent for reducing oxidation thereof.

20 9/ A composition according to any one of claims 1 to 6, characterized in that as its active agent it contains at least one enzyme whose degradation is to be avoided together with a stabilizing agent for avoiding said
25 degradation.

30 10/ A composition according to claim 9, characterized in that said agent for avoiding degradation of said enzyme is a known stabilizing agent for stabilizing proteins, preferably an agent acting on the conformation of the enzyme, in particular an ion, e.g. a calcium ion, or an agent carrying functions suitable for bonding with said enzyme.

35 11/ A composition according to claim 9 or 10, characterized in that said agent for stabilizing said enzyme is selected from surfactants and amphiphilic

molecules containing the following functions or substituted by the following groups:

- quaternary ammoniums;
- amines and ethanolamine;
- 5 • molecules carrying a phosphate function, in particular phospholipids;
- salts and esters of fatty acids;
- salts of polyacids;
- alcohols;
- 10 • glycerol and esters thereof (glycerides);
- polyols, such as polyglycerides, polyethylene-glycol, polypropyleneglycol; and
- sugars such as sorbitol, glucose, lactose, saccharose.

15 12/ A composition according to claim 9 or 10, characterized in that said agent for stabilizing said enzyme is a polymer, selected from the group constituted by:

- 20 • optionally modified polysaccharides such as agarose, guar gums, carrageenans, alginic acid and alginates, pectin, chitosan;
- optionally substituted polyvinylpyrrolidones;
- cellulose and cellulose derivatives such as
- 25 alkylated or functionalized derivatives;
- polyacrylates;
- polyvinylalcohol (PVA) and partially hydrolyzed derivatives of polyvinylacetates;
- polyacrylamides; and
- 30 • polyamides.

13/ A composition according to any one of claims 9 to 12, characterized in that said agent for avoiding degradation of said enzyme is a compound having at least one

35 nitrogen-containing function, in particular a surfactant or a polymer.

14/ A composition according to any one of claims 1 to 13, characterized in that said agent for avoiding degradation of said active agent has an amphiphilic nature, conferring to it an active role in the formulation of the bilayers of said vesicles.

15/ A composition according to any one of claims 1 to 14, characterized in that said agent for stabilizing said active agent constitutes a second active agent.

16/ A composition according to any one of claims 1 to 15, characterized in that said vesicles furthermore comprise at least one agent for reinforcing their leakproofing, said agent being encapsulated within said vesicles or constituting an external coating of said vesicles.

17/ A method of preparing a composition according to any one of claims 1 to 16, the method being characterized in that it comprises the steps of:

• preparing a liquid crystal lamellar phase comprising at least one surfactant and incorporating at least one active agent and an agent for avoiding degradation of said active agent; and

• transforming said liquid crystal phase into multilamellar vesicles of onion-structure by shear.

18/ A method according to claim 17, characterized in that said shear is homogeneous shear.

19/ A method of improving the stability of an active substance and of avoiding degradation thereof, the method being characterized in that it consists in encapsulating said active substance within multilamellar vesicles as defined in any one of claims 1 to 16 or as obtained by the method of claims 17 or 18, having an onion-structure and constituted, from the periphery to the center, by membranes in the form of concentric bi-layers comprising

at least one surfactant, said membranes being separated by an interstitial liquid, said vesicles incorporating within them at least one agent for avoiding degradation of said active agent.

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20/ A method of protecting and/or immobilizing an enzyme, the method being characterized in that it consists in putting said enzyme in the presence of multilamellar vesicles of onion-structure incorporating within them at least one agent for avoiding degradation of said enzyme as defined in any one of claims 10 to 13 or in encapsulating said enzyme within multilamellar vesicles as defined in any one of claims 9 to 13, or as obtained by the method of claim 17 or 18, said vesicles

15 incorporating within them at least one agent for avoiding degradation of said enzyme as defined in any one of claims 10 to 13.

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